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NOTES ON THE FORMS OF CASTELA GALAPAGEIA

ALBAN STEWART

According to the Index Kewensis, the genus Castela Turp. is composed of eleven species, which occur for the most part in Mexico, West Indies, and southern South America, the genus being thus distinctly American in its distribution. One of these species, *C. galapageia* Hook. f., is peculiar to the Galapagos Islands and was described from material collected by Darwin when he visited the Islands on his voyage around the world as naturalist of the Beagle. Darwin collected his material on Chatham Island, and it was not known until nearly sixty years afterwards, when Baur visited the Galapagos Islands, that this species occurred on other islands of this group. Baur succeeded in finding this species on Albemarle, Bindloe, Charles, Chatham, Duncan, Jervis, and James Islands, and the collections made by him were studied by Robinson and Greenman[1] of the Gray Herbarium of Harvard University. Eight years after Baur was on the islands, they were again visited by Snodgrass and Heller of the Hopkins-Stanford Expedition. Their collections of plants were the most complete that had been taken from the islands up to that time, but they succeeded in extending the range of *C. galapageia* to but one other island, viz., James.

The collections of Snodgrass and Heller were studied by Robinson, who, aided by the additional specimens which this collection furnished, thought that he could recognize formal differences in the Castela material. He consequently described six new forms[2] basing his differences mainly on the arming of the stem and the shapes of the leaves. The forms described by Robinson are: albemarlensis, bindloensis, carolensis, duncanensis, jacobensis, and jervensis, the forms being named for the various islands respectively on which the type specimen of each was collected.

I was fortunate enough to secure much additional material of this species when I visited the Galapagos Islands in 1905–1906 as botanist of the expedition sent hence by the California Academy of Sciences, as well as to extend its range to Abingdon, Barrington, Hood, Indefatigable, Narborough, and Seymour, so that this species is now known to occur on all of the larger islands of the group. After returning from the expedition I studied the collections and prepared the results for publication at the Gray Herbarium. I felt some doubt about the distinctness of the forms described by Robinson after I had compared the Academy specimens with his material. In fact I was convinced that the form jervensis did not differ from the form albemarlensis, and I considered it as such in my work upon the flora of these islands.[3] The time at my disposal then would not allow me to make a critical study of this species so that it had to be abandoned until now.

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[1] On the Flora of the Galapagos Islands as Shown by the Collections of Dr. Baur. Amer. Journ. Sci. III., **50**: 135–149. 1895.

[2] Flora of the Galapagos Islands. Proc. Amer. Acad. **38**: 77–269, pls. 1–3. 1902.

FORMA ALBEMARLENSIS Robinson

This form is described as being unarmed or armed with small slender spines. Leaves oblong obtuse mucronate, 1.5–3.4 cm. long, very often furnished with 1–2 small lateral teeth; not shiny above. After comparing the Academy material with the type specimen of this form, I succeeded in a way in matching specimens from Albemarle, Indefatigable, and Narborough Islands with it. The specimens from these islands can be separated into two groups, viz., those which have the stem unarmed, and those which have the stem armed with spines to a greater or less extent. In the unarmed group are specimens from Tagus Cove and Villamil, Albemarle Island, and from the northeast and southeast sides of Indefatigable Island, while in the armed group are specimens from the northwest side of Indefatigable and from Narborough Islands. The armed specimen from Indefatigable Island is provided with short spines which are somewhat thickened at the base, while the specimen from Narborough Island has but one spine on it which is slender and nearly 7 mm. long.

Great variation occurs in the leaf characters of the different specimens, well illustrated in figure 1, which consists of tracings of leaves taken from a specimen collected at Tagus Cove, Albemarle Island. Leaves which are distinctly of the oblong obtuse mucronate type, similar to those described as being typical of this form, occur on this specimen, figure 1 *a*. In addition to this kind of leaf, however, there are still others, which are rather oblanceolate mucronate, figure 1 *b*;

[3] A Botanical Survey of the Galapagos Islands. Proc. Calif. Acad. IV., 1: 82. 1911.

lanceolate mucronulate, figure 1 *c*; spatulate slightly retruse, figure 1 *d*; and obovate retruse mucronate, figure 1 *e*. The leaves are slightly shiny on the upper surface, but as this is a character which seems to vary with the age of the specimen and the care with which it was dried, it can hardly be considered as distinctive. It might be added that, after comparing this specimen with the type specimen of this form, I find that there are leaves very similar in shape to those shown in figure 1*a*, *c*, and *d*, to be found upon it. The margins of many of the leaves on the Academy specimen are somewhat revolute.

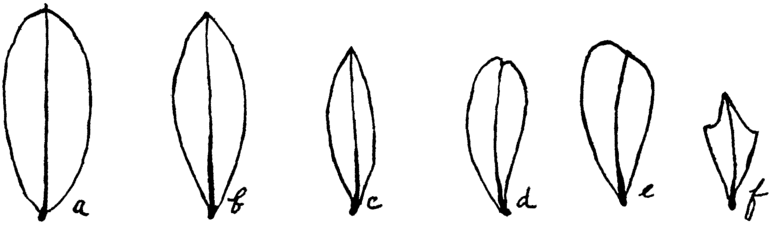

Fig. 1

The specimen from Villamil Albemarle Island has many leaves which are oblong obtuse mucronate, figure 2*a*.

There are still other leaves which are obovate and distinctly retruse, figure 2*b*, and still others which are spatulate, similar to those shown in figure 1*d*. In fact the bases of the most of the leaves on this specimen are rather too attenuate at the base to be considered oblong, approaching more a spatulate shape in this respect. The margins of the leaves are slightly revolute in many instances, as was the case with the specimen from Tagus Cove.

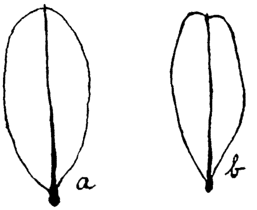

Fig. 2

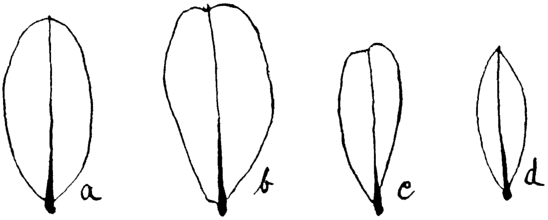

Fig. 3

The specimen from the southeast side of Indefatigable Island has more of its leaves oblong obtuse mucronate in shape than any of the other unarmed specimens assigned to this form. A typical leaf of this kind is shown in figure 3*a*.

In addition to this kind of leaves, there are others which are obovate slightly retruse mucronate, figure 3*b*; spatulate retruse, figure 3*c*; and broadly lanceolate, figure 3*d*. The margins of many of the leaves are slightly revolute.

The specimen from the northeast side of Indefatigable Island has no leaves which are distinctly oblong, as the bases are rather attenuate in nearly every instance. There are a few leaves, however, which approach in shape those described by Robinson, one of which is shown in figure 4*a*. Other kinds of leaves on this specimen are oblanceolate, figure 4*b*; spatulate mucronate, figure 4*c*; and cuneate, figure 4*d*.

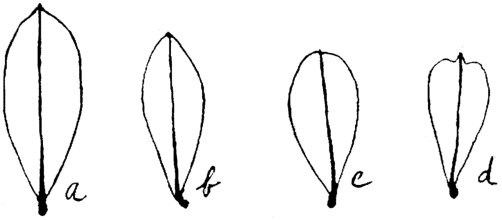

Fig. 4

Many of the leaves of this specimen have strongly revolute margins, a condition that may be brought about by the loose nature of the soil and the extreme dryness of this part of the island. The upper surfaces of many of the leaves are wrinkled, a character which is present to a greater or less extent in many of the Academy specimens. It seems to vary with the age of the leaves as does the character of shininess.

The armed specimen from the northwest side of Indefatigable Island[4] has many leaves which are typical as is shown in figure 5*a*. Other kinds of leaves on this specimen are: oblong retruse, figure 5*b*;

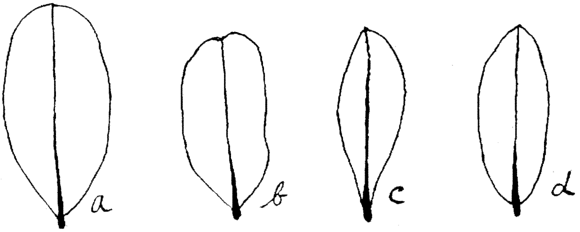

Fig. 5

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[4] Owing to a typographical error this specimen No. 1749 was listed as being from the northeast side of Indefatigable Island in my former work on the Galapagos flora. L.-c., p. 82.

oblanceolate acute mucronate, figure 5*c*; and elliptical mucronate, figure 5*d*. The margins of many of the leaves are revolute.

The leaves on the armed specimen from Narborough Island, taken as a whole, are rather oblong in shape, but with few exceptions they are acute at the apices. The leaves shown in figure 6 are rather typical of this specimen, *a* being oblong acute mucronate, *b* oblong elliptical, similar in size and shape, by the way, to a leaf of the type specimen of this form, and *c* is spatulate.

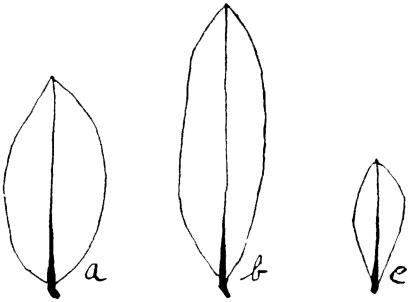

Fig. 6

Strange to say, none of the Academy specimens have the small lateral teeth on the leaves which Robinson[5] mentions as being sometimes present. They are quite evident on the specimen collected by Snodgrass and Heller at Tagus Cove, figure 1*f*, but do not occur on the specimen collected by Baur at the southern end of Albemarle Island, evidently in the vicinity of Villamil.

FORMA BINDLOENSIS Robinson

This form is described as being unarmed, leaves entire obovate rounded or mucronulate, 1–1.6 cm. long; not shiny above. The Academy specimen from Bindloe Island does not agree with this description in several ways, as the stem is armed with rather thick short spines, and the leaves vary quite as much in shape as on the specimens assigned to the form albemarlensis which has just been considered. Leaves similar in shape to the one shown in figure 7*a* occur on the specimen, which are evidently like those described by Robinson except that the apices are slightly retruse. There are leaves which have other shapes, however, such as elliptical, figure 7*b*; spatulate both acute and obtuse, figure 7*c* and *d*; and oblong obtuse mucro-

[5] L. c. p. 158.

nate, figure 7*e*, which, by the way, is the characteristic shape of the leaves on the form albemarlensis. I find that leaves of this shape sometimes occur on the type specimen of bindloensis, a tracing from one of which is shown in figure 7*f*. There are also leaves which are spatulate and rather oblanceolate on the type specimen of this form. There is a tendency for the margins of the leaves to be revolute in both the type, and the Academy specimen.

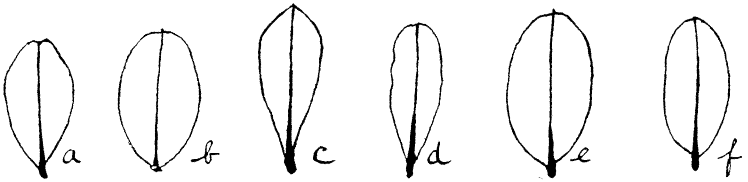

Fig. 7

Forma carolensis Robinson

Described as being armed with short robust spines. Leaves spatulate with manifestly attenuated bases. Upper surface very shiny, 2–2.5 cm. long. Specimens from Abingdon, Charles, Chatham, and South Seymour Islands were assigned to this form in my former work on the Galapagos Island flora.[6] From what has been stated above, it can be seen at once, that, except for the arming of the stem, this description might apply equally well for the type specimen os bindloensis, as spatulate leaves are to be found on it.

There is a great difference in the arming of the stem in the Academy series of specimens, not only from different islands but from the same island as well. Two specimens, assigned to this form in my earlier paper, were collected at Post Office Bay on Charles Island. One of these specimens has spines 1–2.5 cm. long, and it is only on the younger branches that the spines are short. The second specimen from this locality has slender spines, which are somewhat shorter than on the above specimen just described. On neither one of these are the spines short and robust. The type specimen appears to be an old branch so that the shortness of the spines on it can not be due to immaturity.

The spines on the specimen from Abingdon Island are short and robust in some instances while in others they are nearly 1 cm. long.

[6] L. c. p. 83.

The specimen from Chatham Island has short and robust spines, while the specimen from South Seymour is unarmed, as is the type specimen of the species collected on Chatham Island by Darwin.

The leaf characters on this series of specimens are quite variable. The specimen from Abingdon Island has many spatulate leaves, and still others that are rather oblong elliptical, or lanceolate, figure 8.

The most of the leaves are rather acute at both base and apex approaching in this respect the form duncanensis as described by Robinson. There is quite as much variation in the leaf characters of the specimens from Charles Island as there is in the manner of arming of the stem. The leaves are broadly spatulate for the most part on one of these specimens, while on the other they are much narrower, being lanceolate or even linear in some instances. They probably approach closely in shape the leaves on the type specimen of the species as described by Hook. f.

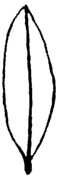

Fig. 8

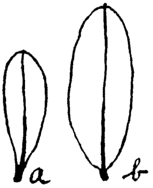

Fig. 9

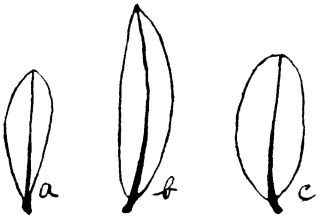

Fig. 10

There are many spatulate leaves on the specimen from Chatham Island, figure 9*a*, but there are others which are oblong obtuse mucronate, figure 9*b*, so that this specimen might be assigned equally well to either of the forms albemarlensis or carolensis on leaf characters, as it has the types of leaves of each. The specimen from South Seymour Island has spatulate leaves, figure 10*a*, those which are lanceolate, figure 10*b*, and also those which are oblong obtuse. Spatulate leaves, described as being typical of this form, also occur on the type specimenf of both the forms albemarlensis and bindloensis as has been mentioned above. It might be well to state in this connection that leaves of this shape occur to a greater or less extent on the Academy specimens from all of the islands where this species was collected.

FORMA DUNCANENSIS Robinson

Described as being unarmed. Leaves entire narrow lanceolate, acute at base and apex. Specimens from Barrington, Duncan, and Jervis Islands have been assigned to it.[7]

Except for the spine-like endings of the lateral branches, the specimen from Barrington Island is weakly armed, but hardly so much as is the specimen from Jervis Island where the spines are very weak indeed. The specimen from Duncan Island has very heavy spines. Notwithstanding the fact that this form is described as being unarmed, there is nevertheless a single weak spine on the type specimen, which is apparently a young and immature branch. The spine might easily be overlooked as it is somewhat hidden by leaves, the specimen being fastened to a herbarium sheet.

The leaves on the Academy specimen of this form from Barrington Island are very small and for the most part are oblanceolate or spatulate in shape with strongly revolute margins. The bases of the leaves may be either obtuse or acute, and the apices are sometimes obtuse. The specimen from Duncan Island in the Academy collection has leaves which for the most part are narrowly spatulate or oblanceolate in shape. In some instances they are nearly linear, a condition apparently brought about by the strongly revolute margins of the leaves. The bases and apices may be either acute or obtuse, both kinds of leaves occurring on the same specimen. The specimen described by Robinson as typical is immature and the leaves are all lanceolate. There is upon the same herbarium sheet, with the type specimen of the form duncanensis, still another specimen, No. 42 (hb. Gr.) from Charles Island which Robinson[8] assigns to the form carolensis with a question. I can find but little difference in these two specimens as the leaves are practically identical in shape on the two. Lanceolate leaves occur on both the type and the Academy specimens of the form albemarlensis as noted above. The leaves on the specimen from Jervis Island are spatulate for the most part, and the leaf margins are less inclined to be revolute than on any other of the Academy specimens assigned to this form. Leaves which are spatulate in shape are thus seen to occur on all of the Academy specimens assigned to this form, and they also occur on all three of the forms previously considered, viz., albemarlensis, bindloensis, and carolensis.

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[7] Stewart, op. cit. 83.

[8] Op. cit. 159.

FORMA JACOBENSIS Robinson

Described as being armed with very short spines. Leaves broadly oblong entire, rounded at base and apex, mucronate, shiny above and transversely wrinkled, 1–1.8 cm. long. It can readily be seen that this description is very similar to that given for the form albemarlensis. The only essential difference between these two descriptions is that the leaves in albemarlensis are somewhat larger and are often furnished with one to two lateral teeth as shown in figure 1*f*. The presence of lateral teeth on the leaves is a rare character, however, as shown by the series of Academy specimens, and the size of the leaves varies greatly even on the same specimen. Spatulate leaves, and those which are lance-oblong in shape occur on the type mentioned. The shininess and wrinkled character of the leaves are not distinctive as mentioned above.

From the above discussion it can be readily seen that characters based on the arming of the stem and the shape of the leaves are too inconstant to be used in establishing formal varieties, and unless more constant characters are found we must conclude that they do not exist in this species. We are of course dealing in such forms with groups of organisms very closely related to each other between which the differences are very slight. However small these differences may be, they must be constant, otherwise the supposed forms cease to exist and we have instead only a group of slightly dissimilar individuals.

This species occurs most abundantly on the lower dryer parts of the islands, but it is not uncommon to find it at elevations from 600 to 1,000 feet. It is well known that climatic conditions vary greatly within comparatively slight differences in elevations on these islands. The lower parts adjacent to the shore are very dry and support a xerophytic vegetation while the upper parts varying usually from 500 to 1,000 or more feet in elevation are moist with a mesophytic vegetation. Between these two there is usually an intermediate or transition region, covered with a vegetation which is made up for the most part of species from both the dry and moist region. Growing under such a variety of conditions as this we would naturally expect that the difference in environment would have a corresponding effect upon the habit and general appearance of this species, and such is the case. I believe, however, that the changes brought about by such causes in Castela are even less marked than in some of the other species of Galapagos plants which occur in like situations.

I wish to acknowledge the kindness of the authorities of the Gray Herbarium in sending me their series of specimens of this species for further study.

Department of Botany,
University of Wisconsin.